Scientific knowledge is arrived at by repeated efforts, with imperfect observation and half-true hypotheses; and every effort is regarded as good and true until further researches and better conclusions eliminate the errors, leaving a residuum of real truth as a basis for further advance. The "subaërialists" and the "submarinists" (we know not, indeed, if there be any pure and simple followers of these schools) may, by their one-sided efforts, help to carry on observation and knowledge; and it seems as unavoidable that this should be the natural method of progress in geology as that by tacking and tacking the wind-stayed ship should make its weary way to port. We look, then, on Mr. Whitaker's pamphlet, comprising his *résumé* of what has been done and his opinions of what ought to be thought, as an effort in the right direction; and we trust that, whether the ship's prow be now too much to windward or the contrary, the voyage is successfully, though laboriously, progressing towards the happy land of geologists, where all the strata will be seen and all the fossils deciphered, where homotaxis and boulder-drift are unknown, where ice will do everything to please some, and water slave for others, where the volcano will give up the secrets of its laboratory to solve the problems of the plutonist, and the hydrothermalist, no longer in hot water, will have his doubts removed.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

April 23, 1868.—Dr. William Allen Miller, Treasurer and Vice-President, in the Chair.

"On the Geographical and Geological Relations of the Fauna and Flora of Palestine." By the Rev. Henry Baker Tristram, M.A., F.G.S.

A detailed examination of the fauna and flora exhibits results remarkably in accordance with the views expressed by Mr. Sclater and Dr. Günther on the geographical distribution of species. Palestine forms an extreme southern province of the Palæarctic region.

In every class, however, there are a group of peculiar forms, which cannot be explained simply by the fact of Palestine impinging closely on the Ethiopian, and more distantly on the Indian region, but which require a reference to the geological history of the country.

The results of the examination of the collections made in 1864 by the expedition assisted by the Royal Society, may be tabulated thus:—

	Total.	Palæarctic.	Ethiopian.	Indian, including those which are also Ethiopian.	Peculiar.
Mammalia	82	41	30*	13	7
Aves	326	258	36†	14	27
Reptilia	48	25	13‡	2	4§
Pisces, fluviatile	17	1	3	3	10‖
Mollusca.....	146	48	8	2	81
Flora, general..	963¶				
Flora, Dead-Sea basin (Phanerogamic)....	113	27	71**	26	3

Several of the Ethiopian Mammalia are sedentary forms, and seem to point to an earlier settlement than across the recent deserts. There is no trace of any immigration from the Indian region. Of the peculiar species, *Hyrax syriacus* belongs to an *exclusively* Ethiopian and isolated type, yet is specifically different from its congeners, which are all most sedentary in their habits.

The Avifauna is very rich in number of species, most unequally distributed. The Ethiopian and Indian types are almost exclusively confined to the Dead-Sea basin, excepting only the desert forms. There are several Indian species, as *Ketupa ceylonensis*, which have no affinities with any Ethiopian forms. Of the *peculiar* species, besides several modifications of well-known Palæarctic forms, there are eleven, belonging to as many different Ethiopian and Indian genera. Three of these are decidedly Indian in their affinities. The Avifauna of the Dead-Sea basin is decidedly distinct and typical, sometimes Indian, more generally Ethiopian in its character.

In the Reptilia there is a less prominent intrusion of Ethiopian types, there being a general similarity to the Egyptian herpetological fauna, which must be classed within the Palæarctic region. The Indian is present in *Daboia xanthina*; and the affinities of a new genus *Rhynchocalamus* are rather obscure. Snakes in particular are more limited to the original locality of the individuals; and the groups, like the individuals, are more stationary.

The fluviatile ichthyological fauna is much more distinct, though the number of species is small. In its consideration we confine ourselves to the Jordan and its tributaries, in which are three Nilotic fishes, three others extending eastward in Asia, six to other rivers of Syria, and four peculiar, bearing a strong affinity to the species and genera (as *Chromis* and *Hemichromis*) of tropical Eastern Africa.

Of the Mollusca, most of the peculiar species have no geographical signification. The Pulmonifera have developed in groups which

* Of which 9 are also Indian.
† Of which 8 are also Indian.
‡ Of which 1 is also Indian.
§ And 5 others Asiatic, but not Indian.
‖ Of which 5 are also Syrian and Asia Minor.
¶ About 1300 species are known from Palestine (Phanerogamic).
** Of which 26 are also Indian.

are modifications of desert types in the south, and of Mediterranean forms on the coast. Variation in this class appears rapidly to follow segregation, as shown by the Jordanic species. The fluviatile mollusca are much more distinct, and indicate a very ancient separation from any adjacent district.

Similar inferences may be drawn from the examination of the Arachnida, Lepidoptera, Hemiptera, and Orthoptera, as well as from the Rhizopod fauna, which is similar to that of the Indian Ocean. (The examination of the Coleoptera is not yet completed.)

The flora of Palestine is, on the coastline and highlands, simply a reproduction of that of the Eastern Mediterranean. That of the Jordan valley is *most* distinct. Of 113 species by the Dead Sea, only 27 are European, and these chiefly weeds of world-wide distribution. In this area the flora is almost exclusively Ethiopian, consisting largely of species extending from the Canaries to India.

Thus in the Dead-Sea basin, an area of but a few square miles, we find a series of forms of life, in all classes, differing from those of the surrounding region, to which they do not extend, and having Ethiopian and, more strictly, Indian affinities. The basin is depressed 1300 feet below the sea-level; and as zones of elevation correspond to parallels of latitude, so here a zone of depression represents the fauna and flora of a low latitude. If the flora were *representative*, this law, that climatal zones of life are mutually repeated and represented by elevation or depression and latitude, would account for their existence.

But we have a *transported* flora; this negatives the idea of an independent origin on the spot. The theory of migration, *under present conditions*, is refuted by the coexistence of peculiar and unique forms with others now found in regions widely apart. Of these, the physical character, and the phenomena of their present distribution, present insuperable obstacles to their migration under *existing* geological conditions.

Their existence must be mainly due to dispersion before the isolation of the area; this must have been after the close of the Eocene period, to which belong the most recent superficial deposits of Southern Palestine. There are no beds synchronizing with the miocene deposits of Sicily &c.; it must have had a fauna and flora contemporaneous with the miocene flora of Germany. There is geological evidence that since the Eocene period the Jordan fissure has had no connexion with the Red Sea or Mediterranean. There are *subsequent* vast marl deposits of the Dead Sea when it was at a higher level; but they are wholly unfossiliferous. The diminution of the waters may, for reasons given, be fixed about the close of the tertiary epoch. We have also evidence of the extension of the glacial period thus far south, as in the moraines of Lebanon.

Still the lake existed in its present form before the glacial epoch, when there was an unusually warmer climate, and the more antique Ethiopian fauna and flora had a more northerly extension. This would be contemporaneous with the miocene continent of Atlantis, and the Asturian flora of South-west Ireland.

Palestine would then be East African. Afterwards the glacial inroad would destroy the mass of preexisting life, excepting the few species most tenacious of existence, which survive in the still comparatively warm depression of the Jordan valley, which thus became a tropical "outlier," analogous to the boreal marine outliers of our own seas. The Indian types are explained by the former continuous miocene continent from India to Africa. The peculiar species may either yet be found in Arabia, or, if not, may be descendants of species which inhabited the country with a limited range, or may be variations stereotyped by isolation.

The peculiar fishes of the Jordan are most important, dating probably from the earliest period after the elevation of the land. The genera of the peculiar species are exclusively African, while the species are *representative* rather than identical. We may explain this by the miocene chain of freshwater lakes, extending from Galilee to the Nyanza, Nyassa, and Zambesi, when an ichthyological fauna was developed suited to the warm conditions that prevailed, part of which survives in the Jordan.

During the glacial period Lebanon must have been similar in temperature to the present Alps, as the existing mammals and birds on the summits are identical with those of the Pyrenees and the Alps; not so the glacial flora, of which almost every trace has been lost. But the flora had not the same powers of vertical migration with the fauna, of which, however, the Elk, Red Deer, and Reindeer, found in the bone-caverns, have long since perished.

During the present period the Mediterranean forms have overspread the whole country, excepting the mountain-tops at an elevation of 9000 feet and the Jordan depression. These two exceptions can be best explained by the fact that the traces of the glacial inroad are not yet wholly obliterated, and that the preceding warm period has left its yet stronger mark in the unique tropical "outlier" of the Dead-Sea basin, analogous to the boreal outliers of our mountain-tops, the concave depression in the one being the complement of the convex elevation in the other.

ROYAL INSTITUTION OF GREAT BRITAIN.

February 7, 1868.

"On the Animals which are most nearly intermediate between Birds and Reptiles." By Professor Huxley, LL.D., F.R.S.

Those who hold the doctrine of Evolution (and I am one of them) conceive that there are grounds for believing that the world, with all that is in it and on it, did not come into existence in the condition in which we now see it, nor in anything approaching that condition.

On the contrary, they hold that the present conformation and composition of the earth's crust, the distribution of land and water, and the infinitely diversified forms of animals and plants which constitute its present population, are merely the final terms in an immense series of changes which have been brought about, in the course of

immeasurable time, by the operation of causes more or less similar to those which are at work at the present day.

Perhaps this doctrine of evolution is not maintained consciously and in its logical integrity by a very great number of persons *. But many hold particular applications of it without committing themselves to the whole; and many, on the other hand, favour the general doctrine without giving an absolute assent to its particular applications.

Thus, one who adopts the nebular hypothesis in astronomy, or is a uniformitarian in geology, or a Darwinian in biology, is so far an adherent of the doctrine of evolution.

And, as I can testify from personal experience, it is possible to have a complete faith in the general doctrine of evolution and yet to hesitate in accepting the nebular, or the uniformitarian, or the Darwinian hypotheses in all their integrity and fulness; for many of the objections which are brought against these various hypotheses affect them only, and, even if they be valid, leave the general doctrine of evolution untouched.

On the other hand, it must be admitted that some arguments which are adduced against particular forms of the doctrine of evolution would very seriously affect the whole doctrine if they were proof against refutation.

For example, there is an objection which I see constantly and confidently urged against Mr. Darwin's views, but which really strikes at the heart of the whole doctrine of evolution, so far as it is applied to the organic world.

It is admitted on all sides that existing animals and plants are marked out by natural intervals into sundry very distinct groups: insects are widely different from fish, fish from reptiles, reptiles from mammals, and so on. And out of this fact arises the very pertinent objection, How is it, if all animals have proceeded by gradual modification from a common stock, that these great gaps exist?

We, who believe in evolution, reply that these gaps were once non-existent; that the connecting forms existed in previous epochs of the world's history, but that they have died out.

Naturally enough, then, we are asked to produce these extinct forms of life. Among the innumerable fossils of all ages which exist, we are asked to point to those which constitute such connecting forms.

Our reply to this request is, in most cases, an admission that such forms are not forthcoming; and we account for this failure of the needful evidence by the known imperfection of the geological record. We say that the series of formations with which we are acquainted is but a small fraction of those which have existed, and that between those which we know there are great breaks and gaps.

* The only complete and systematic statement of the doctrine with which I am acquainted is that contained in Mr. Herbert Spencer's 'System of Philosophy,' a work which should be carefully studied by all who desire to know whither scientific thought is tending.

I believe that these excuses have very great force; but I cannot smother the uncomfortable feeling that they are excuses.

If a landed proprietor is asked to produce the title-deeds of his estate, and is obliged to reply that some of them were destroyed in a fire a century ago, that some were carried off by a dishonest attorney, and that the rest are in a safe somewhere, but that he really cannot lay his hands upon them, he cannot, I think, feel pleasantly secure, though all his allegations may be correct and his ownership indisputable. But a doctrine is a scientific estate, and the holder must always be able to produce his title-deeds, in the way of direct evidence, or take the penalty of that peculiar discomfort to which I have referred.

You will not be surprised, therefore, if I take this opportunity of pointing out that the objection to the doctrine of evolution, drawn from the supposed absence of intermediate forms in the fossil state, certainly does not hold good in all cases. In short, if I cannot produce the complete title-deeds of the doctrine of animal evolution, I am able to show a considerable piece of parchment evidently belonging to them.

To superficial observation no two groups of beings can appear to be more entirely dissimilar than reptiles and birds. Placed side by side, a Humming-bird and a Tortoise, an Ostrich and a Crocodile offer the strongest contrast, and a Stork seems to have little but animality in common with the Snake it swallows.

Careful investigation has shown, indeed, that these obvious differences are of a much more superficial character than might have been suspected, and that reptiles and birds do really agree much more closely than birds with mammals, or reptiles with amphibians. But still, "though not as wide as a church-door or as deep as a well," the gap between the two groups, in the present world, is considerable enough.

Without attempting to plunge you into the depths of anatomy, and confining myself to that osseous system to which those who desire to compare extinct with living animals are almost entirely restricted, I may mention the following as the most important differences between all the birds and reptiles which at present exist.

1. The pinion of a bird, which answers to the hand of a man or to the fore paw of a reptile, contains neither more nor fewer than three fingers. These answer to the thumb and the two succeeding fingers in man, and have their metacarpals connected together by firm bony union, or ankylosed. Claws are developed upon the ends of at most two of the three fingers (that answering to the thumb and the next), and are sometimes entirely absent.

No reptile with well-developed fore limbs has so few as three fingers; nor are the metacarpal bones of these ever united together; nor do they present fewer than three claws at their terminations.

2. The breast-bone of a bird becomes converted into a membrane bone, and ossification commences in it from at least two centres. The breast-bone of no reptile becomes converted into a membrane bone, nor does it ever ossify from several distinct centres.

3. A considerable number of caudal and lumbar, or dorsal, vertebræ unite together with the proper sacral vertebræ of a bird to form its "sacrum." In reptiles the same region of the spine is constituted by the one or two sacral vertebræ.

4. In Birds the haunch-bone (ilium) extends far in front of, as well as behind, the acetabulum; the ischia and pubes are directed backwards, almost parallel with it and with one another; the ischia do not unite in the ventral middle line of the body.

In reptiles, on the contrary, the haunch-bone is not produced in front of the acetabulum; and the axes of the ischia and pubes diverge and lie more or less at right angles to that of the illium. The ischia always unite in the middle ventral line of the body.

5. In all birds the axis of the thigh-bone lies nearly parallel with the median plane of the body (as in ordinary Mammalia) in the natural position of the leg. In reptiles it stands out at a more or less open angle with the median plane.

6. In birds, one half of the tarsus is inseparably united with the tibia, the other half with the metatarsal bone of the foot. This is not the case in reptiles.

7. Birds never have more than four toes, the fifth being always absent. The metatarsal of the hallux, or great toe, is always short and incomplete above. The other metatarsals are ankylosed together, and unite with one half of the tarsus, so as to form a single bone, which is called the tarso-metatarsus.

Reptiles with completely developed hind limbs have at fewest four toes, the metatarsals of which are all complete and distinct from one another.

Although all existing birds differ thus definitely from existing reptiles, one comparatively small section comes nearer reptiles than the others. These are the *Ratitæ*, or struthious birds, comprising the Ostrich, Rhea, Emu, Cassowary, Apteryx, and the but recently extinct (if they be really extinct) birds of New Zealand, *Dinornis* &c., which attained gigantic dimensions. All these birds are remarkable for the small size of their wings, the absence of a crest or keel upon the breast-bone, and of a complete furcula; in many cases, for the late union of the bones of the pinion, the foot, and the skull. In this last character, in the form of the sternum, of the shoulder-girdle, and in some peculiarities of the skull, these birds are more reptilian than the rest; but the total amount of approximation to the reptilian type is but small, and the gap between reptiles and birds is but very slightly narrowed by their existence.

How far can this gap be filled up by a reference to the records of the life of past ages?

This question resolves itself into two:—

1. Are any fossil birds more reptilian than any of those now living?

2. Are any fossil reptiles more bird-like than living reptiles?

And I shall endeavour to show that both these questions must be answered in the affirmative.

It is very instructive to note by how mere a chance it is we happen to know that a fossil bird, more reptilian in some respects than any now living, once existed.

Bones of birds have been obtained from rocks of very various dates in the Tertiary series without revealing any forms but such as would range themselves among existing families.

A few years ago the great Mesozoic formations had yielded only the few fragmentary ornitholites which have been discovered in the Cambridge greensand, and which are insufficient for the complete determination of the affinities of the bird to which they belonged.

However, the very fine calcareous mud of the ancient Oolitic sea-bottom which has now hardened into the famous lithographic slate of Solenhofen, and has preserved innumerable delicate organisms of the existence of which we should otherwise have been, in all probability, totally ignorant, in 1861 revealed the impression of a feather to the famous palæontologist Hermann von Meyer. Von Meyer named the unknown bird to which this feather belonged *Archæopteryx lithographica*; and in the same year the independent discovery by Dr. Häberlein of the precious skeleton of the *Archæopteryx* itself, which now adorns the British Museum *, demonstrated the chief characters of this very early bird. But it must be remembered that this feather and this imperfect skeleton are the sole remains of birds which have yet been obtained in all that great series of formations known as Wealden and Oolite, which partly lie above, and partly correspond with, the Solenhofen slates.

Though some palæontologists may be forced, by a sense of consistency, to declare that the class of birds was created in the sole person of *Archæopteryx* during the deposition of the Solenhofen slates and disappeared during the Wealden, to be recreated in the Greensand, to vanish once more during the Cretaceous epoch and reappear in the Tertiaries, I incline to the hypothesis that many birds beside *Archæopteryx* existed throughout all this period of time, and that we know nothing about them, simply because we do not happen to have hit upon those deposits in which their remains are preserved.

Now, what is this *Archæopteryx* like? Unfortunately the skull is lost; but the leg and foot, the pelvis, the shoulder-girdle, and the feathers, so far as their structure can be made out, are completely those of existing ordinary birds.

On the other hand, the tail is very long, and more like that of a reptile than that of a bird in this respect. Two digits of the manus have curved claws, much stronger than those of any existing bird; and, to all appearance, the metacarpal bones are quite free and disunited.

Thus it is a matter of fact that, in certain particulars, the oldest known bird does exhibit a closer approximation to reptilian structure than any modern bird.

Are any fossil reptiles more bird-like than those which now exist?

* The fossil has been described by Professor Owen, in the 'Philosophical Transactions' for 1863.

As in the case of birds, the tertiary formations yield no trace of reptiles which depart from the type of the existing groups. But otherwise than is true of birds, the newest of the Mesozoic formations, the chalk, makes us acquainted with reptiles which, at first sight, seem to approach birds in a very marked manner. These are those flying reptiles the Pterodactyles, which resemble the great majority of birds in the presence of air-cavities in their bones, in the wonderfully bird-like aspect of their coracoid and scapula, and in their broad sternum with its median crest. Furthermore, in some of the Pterodactyles, the præmaxillæ and the symphysial part of the mandibles were prolonged into beaks, which appear to have been sheathed in horn, while the rest of each jaw was armed with teeth.

But horn-sheathed beaks are found in reptiles as well as in birds; the structure of the scapulo-coracoid arch and of the sternum, and the pneumaticity of the bones vary greatly among birds themselves; and these characters of the Pterodactyles may be merely adaptive modifications.

On the other hand, the manus has four free digits, the three inner of which are strongly clawed, while the fourth is enormously prolonged, in total contrast to the abortion of the corresponding digit in birds. The pelvis is as wholly unlike that of birds as is the hind limb and foot.

Thus it appears that Pterodactyles, among reptiles, approach birds much as Bats, among mammals, may be said to do so. They are a sort of reptilian Bats * rather than links between reptiles and birds; and it is precisely in those organs which in birds are the most characteristically ornithic, the manus and the pes, that they depart most widely from the ornithic type.

Clearly, then, the passage from reptiles to birds is not from the flying reptile to the flying bird. Let us try another line. I have already observed that in the existing world the nearest approximation to reptiles is presented by certain land birds, the Ostriches and their allies, all of which are devoid of the power of flight by reason of the small relative size of their fore limbs and of the character of their feathers.

Can we find any extinct reptiles which approached these flightless birds, not merely in the weakness of their fore limbs, but in other and more important characters?

I imagine that we can, if we cast our eyes in what at first sight seems to be a most unlikely direction.

The *Dinosauria*, a group of extinct reptiles, containing the genera *Iguanodon*, *Hadrosaurus*, *Megalosaurus*, *Poikilopleuron*, *Scelidosaurus*, *Plateosaurus*, &c., which occur throughout the whole series of the Mesozoic rocks, and are, for the most part, of gigantic size, appear to me to furnish the required conditions.

In none of these animals is the skull or the cervical region of

* It will be understood that I do not suggest any direct affinity between Pterodactyles and Bats.

the vertebral column completely known, while the sternum and the manus have not yet been obtained in any of the genera. In none has any trace of a clavicle been observed.

With regard to the characters which have been positively determined, it has been ascertained that :—

1. From four to six vertebræ enter into the composition of the sacrum, and become connected with the ilia in a manner which is partly ornithic, partly reptilian.

2. The ilia are prolonged forwards in front of the acetabulum as well as behind it; and the resemblance to the bird's ilium thus produced is greatly increased by the widely arched form of the acetabular margin of the bone, and the extensive perforation of the floor of the acetabulum.

3. The other two components of the *os innominatum* have not been observed actually in place; indeed only one of them is known at all; but that one is exceedingly remarkable from its strongly ornithic character. It is the bone which has been called "clavicle" in *Megalosaurus* and *Iguanodon* by Cuvier and his successors, though the sagacious Buckland had hinted its real nature *. But these bones are not in the least like the clavicles of any animal which possesses a clavicle, while they are extremely similar to the ischia of such a bird as an ostrich; and in the only instance in which they have been found in tolerably undisturbed relation with other parts of the skeleton, namely, in the Maidstone *Iguanodon*, they lie, one upon each side of the body, close to the ilia. I hold it to be certain that these bones belong to the pelvis, and not to the shoulder-girdle, and I think it probable that they are ischia; but I do not deny that they may be pubes.

4. The head of the femur is set on at right angles to the shaft of the bone, so that the axis of the thigh-bone must have been parallel with the middle vertical plane of the body, as in birds.

5. The posterior surface of the external condyle of the femur presents a strong crest, which passes between the head of the fibula and the tibia as in birds. There is only a rudiment of this structure in other reptiles.

6. The tibia has a great anterior or "procnemial" crest, convex on the inner and concave on the outer side. Nothing comparable to this exists in other reptiles; but a correspondingly developed crest exists in the great majority of birds, especially such as have great walking or swimming powers.

7. The lower extremity of the fibula is much smaller than the other; it is, proportionally, a more slender bone than in other reptiles. In birds the distal end of the fibula thins away to a point, and it is a still more slender bone.

8. *Scelidosaurus* has four complete toes, but there is a rudiment of a fifth metatarsal. The third or middle toe is the largest, and the

* The so-called "coracoid" of *Megalosaurus* is the ilium. I am indebted to Professor Phillips, and to the splendid collection of Megalosaurian remains which he has formed at Oxford, for most important evidence touching this reptile.

metatarsal of the hallux is much smaller at its proximal than at its distal end.

Iguanodon has three large toes, of which the middle is the longest. The slender proximal end of a first metatarsal has been found adherent to the inner face of the second; so that if the hallux was completely developed, it was probably very small. No rudiment of the outer toe has been observed.

It is clear, from the manner in which the three principal metatarsals articulate together, that they were very intimately and firmly united, and that a sufficient base for the support of the body was afforded by the spreading out of the phalangeal regions of the toes.

From the great difference in size between the fore and hind limbs, Mantell, and more recently Leidy, have concluded that the *Dinosauria* (at least *Iguanodon* and *Hadrosaurus*) may have supported themselves for a longer or shorter period upon their hind legs. But the discovery made in the weald, by Mr. Beckles, of pairs of large three-toed footprints, of such a size and at such a distance apart that it is difficult to believe they can have been made by anything but an *Iguanodon*, lead to the supposition that this vast reptile, and perhaps others of its family, must have walked, temporarily or permanently, upon its hind legs.

However this may be, there can be no doubt that the hind quarters of the *Dinosauria* wonderfully approached those of birds in their general structure, and therefore that these extinct reptiles were more closely allied to birds than any which now live.

But a single specimen, obtained from those Solenhofen slates to the accident of whose existence and usefulness in the arts palæontology is so much indebted, affords a still nearer approximation to the "missing link" between reptiles and birds. This is the singular reptile which has been described and named *Compsognathus longipes* by the late Andreas Wagner, and some of the more recondite ornithic affinities of which have been since pointed out by Gegenbaur. Notwithstanding its small size (it was not much more than 2 feet in length), this reptile must, I think, be placed among, or close to, the *Dinosauria*; but it is still more bird-like than any of the animals which are ordinarily included in that group.

Compsognathus longipes has a light head, with toothed jaws, supported upon a very long and slender neck. The ilia are prolonged in front of and behind the acetabulum. The pubes seem to have been remarkably long and slender (a circumstance which rather favours the interpretation of the so-called "clavicles" of *Iguanodon* as pubes). The fore limb is very small. The bones of the manus are unfortunately shattered; but only four claws are to be found, so that possibly each manus may have had but two clawed digits.

The hind limb is very large, and disposed as in birds. As in the latter class, the femur is shorter than the tibia—a circumstance in which *Compsognathus* is more ornithic than the ordinary *Dinosauria*.

The proximal division of the tarsus is ankylosed with the tibia, as in birds. In the foot the distal tarsals are not united with the three

long and slender metatarsals, which answer to the second, third, and fourth toes. Of the fifth toe there is only a rudimentary metatarsal. The hallux is short, and its metatarsal appears to be deficient at its proximal end.

It is impossible to look at the conformation of this strange reptile and to doubt that it hopped or walked, in an erect or semierect position, after the manner of a bird, to which its long neck, slight head, and small anterior limbs must have given it an extraordinary resemblance.

I have now, I hope, redeemed my promise to show that, in past times, birds more like reptiles than any now living, and reptiles more like birds than any now living, did really exist.

But, on the mere doctrine of chances, it would be the height of improbability that the couple of skeletons, each unique of its kind, which have been preserved in those comparatively small beds of Solenhofen slate, which record the life of a fraction of Mesozoic time, should be the relics, the one of the most reptilian of birds, and the other of the most ornithic of reptiles.

And this conclusion acquires a far greater force when we reflect upon that wonderful evidence of the life of the Triassic age which is afforded us by the sandstones of Connecticut. It is true that these have yielded neither feathers nor bones; but the creatures which traversed them when they were the sandy beaches of a quiet sea have left innumerable tracks which are full of instructive suggestion. Many of these tracks are wholly undistinguishable from those of modern birds in form and size; others are gigantic three-toed impressions, like those of the Weald of our own country; others are more like the marks left by existing reptiles or Amphibia.

The important truth which these tracks reveal is, that at the commencement of the Mesozoic epoch bipedal animals existed which had the feet of birds, and walked in the same erect or semierect fashion. These bipeds were either birds or reptiles, or more probably both; and it can hardly be doubted that a lithographic slate of Triassic age would yield birds so much more reptilian than *Archæopteryx*, and reptiles so much more ornithic than *Compsognathus*, as to obliterate completely the gap which they still leave between reptiles and birds.

But if, on tracing the forms of animal life back in time, we meet, as a matter of fact, with reptiles which depart from the general type to become bird-like, until it is by no means difficult to imagine a creature completely intermediate between *Dromæus* and *Compsognathus*, surely there is nothing very wild or illegitimate in the hypothesis that the *phylum* of the class Aves has its root in the Dinosaurian reptiles—that these, passing through a series of such modifications as are exhibited in one of their phases by *Compsognathus*, have given rise to the *Ratitæ*—while the *Carinatæ* are still further modifications and differentiations of these last, attaining their highest specialization in the existing world in the Penguins, the Cormorants, the birds of prey, the Parrots, and the song-birds.

However, as many completely differentiated birds in all probability existed even in the Triassic epoch, and as we possess hardly any knowledge of the terrestrial reptiles of that period, it may be regarded as certain that we have no knowledge of the animals which linked reptiles and birds together historically and genetically, and that the *Dinosauria*, with *Compsognathus*, *Archæopteryx*, and the struthious birds, only help us to form a reasonable conception of what these intermediate forms may have been.

In conclusion, I think I have shown cause for the assertion that the facts of palæontology, so far as birds and reptiles are concerned, are not opposed to the doctrine of evolution, but, on the contrary, are quite such as that doctrine would lead us to expect; for they enable us to form a conception of the manner in which birds may have been evolved from reptiles, and thereby justify us in maintaining the superiority of the hypothesis that birds have been so originated to all hypotheses which are devoid of an equivalent basis of fact.

MISCELLANEOUS.

Occurrence of Tinnunculus cenchris *in Britain.*

By W. S. Dallas, F.L.S.

This Museum has just been fortunate enough to obtain a fine specimen, killed within a few miles of York, of a species of Falcon, the occurrence of which in this country has, I believe, never before been authentically recorded,—namely, the little Kestrel of South-eastern Europe, *Tinnunculus cenchris* (Naum.). The specimen, which is a mature but apparently not an old male, was presented to the Museum by Mr. John Harrison, of Wilstrop Hall, near Green Hammerton, who shot it upon his farm at that place, after having observed it for some little time flying about. The date, he thinks, was about the middle of last November; but of this he took no note, as he at first thought that the bird was merely a small and curious variety of the common Kestrel. It, however, presents all the distinctive characters of *Tinnunculus cenchris*, among which the yellowish-white claws may be mentioned as affording an easy means of identifying the bird.

Mr. Graham, of York, to whose intervention the Museum is indebted for the acquisition of this interesting specimen, has informed me that, on a recent excursion of his, he saw another example of this species, in the possession of the Rev. Charles Hudson, of Trowell, near Nottingham. On my writing to that gentleman, he kindly informed me that the specimen of the "small Kestrel" had been in his possession for about eight years, and that he purchased it from a joiner named Brown, formerly living at Thorpe Hall, near Bridlington, who was an enthusiastic collector of birds, and in the habit of preparing them for people in that neighbourhood. Brown's account of the bird, which he denominated the "American Falcon,"